Appendix A: Travel Demand Management Evaluation Model

Overview of Technique

A number of TCMs were evaluated through a special analytic tool called the TDM Evaluation Model. The TDM Model was developed by COMSIS Corporation of Silver Spring, Maryland for the express purpose of quick, quantitative analysis of the travel impacts of Travel Demand Management strategies. This model was developed in the late 1980's by COMSIS, drawing upon its nationwide research in TDM, and is in use by numerous Metropolitan Planning Organizations around the country. A public-domain version of the TDM Model was sponsored by the Federal Highway Administration in 1993, and is now being released through McTrans.

The TDM Model is a self-contained software package that operates on a microcomputer. The user inputs scenario assumptions on a system of worksheet screens. Strategies may be tested individually or in combination, where interactive effects are accounted for. Input data is generally in the form of trip tables, although surveys or other sources may be used.

The model is essentially a "pivot point" technique; this means that it discerns the current condition of the travel environment from the modal split of the background travel data, and then projects the change in modal split due to the tested policies or strategies as departures from this starting point. Thus, it is not necessary to compile detailed information on starting conditions. While this is the model's strength, it is also its limitation — the TDM Model does not operate at the same level of detail as the regional mode choice model (within the 4 step process).

The TDM Model was designed to be (1) a quick, reasonably accurate, and interactive "policy" tool, and (2) a device capable of providing quantitative estimates of TDM strategies, such as employer support measures and alternative work hours, which are not readily handled by existing transportation planning models. It also has special faculties to deal with partial "participation" of the employment base, such as might happen when adoption of TDM is elective or imposed on only a portion of the population, such as employers of 100 or more.

Types of Strategies

A wide range of strategies can be examined in the TDM model. Mainly, the model was developed to address employer-based TDM. However, it can also look at areawide measures, such as transit improvements, HOV lanes, and a range of pricing actions. The following list highlights the measures that can be examined with the TDM Model.

Employer Support Measures:

- Information programs
- Employer transportation coordinators

Flexible work schedules
Rideshare matching
Vanpool formation and support
Transit pass sales
Preferential parking for HOVs
Guaranteed ride home

Alternate Work Schedules:

Flexible work hours
Staggered work hours
Compressed work weeks (4/40 and 9/80)
Telecommuting

Financial Incentives and Disincentives:

Modal subsidies for transit, carpool or vanpool
Parking surcharges

The TDM Model was judged to be the most appropriate tool for evaluating the following TCMs in this study:

17. Employer Trip Reduction Programs
18. Regional Ridesharing Program
19. $25 Transit Check
20. Telecommuting
21. Compressed Work Weeks
24. $3 Regional Parking Surcharge
25. $3 CBD Parking Tax
26. New Park & Ride Lots Along Highways
27. Expanded Park & Ride Lots at Rail Stations

There were characteristics of these measures that made it difficult or impossible to use the regional mode choice model for their evaluation, while the TDM Model was either directly suited to their evaluation, or was the best compromise analytic tool (could be made to work with some creativity in assumptions/input data). The reader should consult the individual measure worksheets in Section 2 to gain insight as to why and how the TDM model was applied in these cases.

Computational Characteristics

The primary computational characteristic of the TDM Model is that it operates as a "pivot point" tool. While it is based largely on elasticity relationships derived from and applied within the context of a logit model, it differs from the DVRPC regional mode choice model in important ways. In the latter, information must be relayed to the model on performance characteristics (time, cost) of each travel alternative for each origin-destination pair from the trip table under consideration. Subsequently, when policies or strategies are applied to any given mode, it is necessary to access and modify the appropriate "skim" (performance vector) for that mode for each origin-destination where it is changed, and uniquely for the changes that apply in that origin-destination pair. While this is the most accurate way to relate system performance changes, it is a very intensive and tedious process. The pivot point approach, in contrast, simply takes the current modal shares (mode split) for each origin-destination pair and "adjusts" those shares in relation to the particular strategy or strategies which are being applied. It does this through elasticity relationships, using (in most cases) the same coefficients as exist in the regional mode choice model. For reasonable changes in conditions (i.e., travel time or cost) from the current starting point, these estimated changes in share are fairly accurate. Moreover, the TDM model handles the interactive (cross-elasticity) effect; when more than one strategy is applied or more than one mode is being affected, the result is different than the simple sum of the individual measures applied alone. The TDM Model performs this assessment simultaneously through equations where the overall utility is adjusted for each mode for each strategy, just as the regional logit model would do — it simply is doing that calculation from a starting pivot rather than from scratch.

There are two primary types of analytic procedures operating in the TDM Model. Policies/strategies which represent changes in travel time or cost are handled through a logit model type of formulation. The coefficients for this procedure are taken from the regional mode choice model, although national default coefficients are also available in the model. The second type of policy/strategy is estimated using values from empirical look-up tables. In the present TDM Model, this is the procedure used to estimate the effect of non-monetary employer-based support strategies and alternative work schedules. The reason for this is that conventional elasticity relationships for these measures had not yet been developed at the time of the TDM Model. The current values are empirically derived from the extensive research on employer-based TDM programs by COMSIS and others (which has been published in *Evaluation of TDM Measures to Alleviate Traffic Congestion* (COMSIS for the Federal Highway Administration, 1990) and *Implementation of Effective TDM Measures* (COMSIS for the Federal Highway and Federal Transit Administrations, 1993). To account for differences that clearly occur in the level of impact of these types of strategies, the impact values entered in the TDM model vary by type of employer, size of employer, and type of participation as affected by law/regulation (voluntary/mandatory).

Data Requirements

The TDM Model most commonly utilizes the same trip table information as is generated in the conventional 4-step process. It requires information on Person Trips, Vehicle Trips and Transit [Person] Trips for each origin-destination pair. It will perform its mode split computation for every O-D pair for which it has information.

The input trip tables can be in a variety of formats. The TDM Model has been designed to directly exchange information with MINUTP, TRANPLAN and EMME/2, and uses ASCII format as an ultimate default. It will process trip tables up to 1,100 zones, although its operating complexity/speed suggests that it was designed for much smaller trip table configurations, i.e., ideally under 100.

For the DVRPC analysis, the TDM model evaluations were run using a district-level trip table. In total, 71 districts, or Planning Areas, are used to define the DVRPC region. Of these, districts 1 through 51 constitute the Pennsylvania portion of the region, with the remainder located in New Jersey. When the TDM Model (or any of the analysis tools) were applied, the scheme was to assume targeting of TCMs to trip table destinations in Pennsylvania only, which means that regional travelers located in New Jersey would be affected by TCMs sited in Pennsylvania. From an emissions perspective, only VMT changes occurring on Pennsylvania roadways were included in the emissions calculations.

These trip table inputs were taken from DVRPC's regional model, processed by the TDM Model, and revised trip tables returned to DVRPC for assignment to the highway network. The revised assignments were then returned to COMSIS for estimation of emissions through the PPAQ model.

Model Outputs

For each run of the TDM model, the following output results are generated:

A revised set of trip tables (person, vehicle, transit) for each tested scenario; and

A tabular output report record that relates the change in modal split, and person, vehicle, and transit trips for each scenario. A sample of this tabular summary report is shown below.

Test Scenario

	PERCENT MODE SHARE					PEAK HOUR			% REDUCTION		
	DA	TRN	CP	VP	AVR	PERSON TRIPS	VEHICLE TRIPS	V M T	PERS TRIPS	VEH TRIPS	VMT
0	77.1	2.4	20.6	.0	1.15	7176	6240	24609			
1	69.6	3.7	26.5	.3	1.21	7134	5872	22993	.6	5.9	6.6
2	58.7	5.1	35.0	1.2	1.33	7062	5327	20823	1.6	14.6	15.4
3	48.1	6.4	43.2	2.2	1.45	6993	4810	18762	2.6	22.9	23.8
4	45.8	6.8	44.9	2.6	1.49	6974	4687	18279	2.8	24.9	25.7

Scenario Descriptions

0 Base Conditions
1 Trial 1
2 Trial 2
3 Trial 3
4 Trial 4

Appendix B: Sketch Planning Analysis

Overview of Technique:

The task of evaluating a broad system of Transportation Control Measures was found to be a challenging process, not only to DVRPC but to all agencies involved in TCM analysis for SIP development. The current transportation planning process was not designed for examining many of these innovative measures, and in many cases was not found to be particularly suitable (or at all suitable) for their evaluation. In these instances, it has been necessary to develop alternative means for evaluating these measures; the TDM Model, which is discussed in the previous appendix, has provided one such means. The more general approach to structuring an analysis in the absence of a pre-existing formal technique has been referred to here as "sketch planning".

TCMs which are reasonably handled by the mode choice feature in the conventional 4-step planning process are those involving rather direct changes in travel time or cost. Good examples are most transit service improvements, highway system changes, and pricing actions. If the effect of these measures varies importantly by service/location, or is only being applied to a corridor, subarea or jurisdiction, the conventional mode choice model is the best choice.

Many TCMs do not readily conform to this format, however, because of their unique nature, and hence are not well-handled by the standard 4-step process. Specific TCMs on the DVRPC list which were evaluated in whole or in large part through sketch planning methods are:

1. Advanced Signals on 4-Lane Arterials
2. Advanced Signalization in Philadelphia CBD
3. Incident Management Systems
4. Ramp Metering
14. Reuse of Surplus LRVs and Trackless Trolleys
16. Philadelphia/Harrisburg Rail Service Improvements
20. Telecommuting
21. Compressed Work Weeks
22. Prohibit Construction of New Parking in CBD
23. Limit Supply of Parking at New Suburban Employment Sites
26. New Park & Ride Lots along Highways
27. Expand Parking at Rail Stations
28. Improved Bike Facilities for Work Trips
29. Improved Bike Access for Rail Trips
30. Improved Bike Access for Non-Work Trips

For these measures, case specific procedures and methodologies had to be developed to arrive at a sound, defensible estimate of the probable impact of the measure on travel and emissions. The reader will need to consult the individual measure documentation in Section 2 to properly understand the particular methodology for each of these applications, but in general the techniques developed

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